M. Meyer's value is therefore nearly twice as great as that of this paper, while that of Professor Stokes is only half as great.

In M. Meyer's experiments, which were with one disk at a time in an open space of air, the influence of the air near the edge of the disk is very considerable; but M. Meyer (Crelle, 59; Pogg. cxiii. 76) seems to have arrived at the conclusion that the additional effect of the air at the edge is proportional to the thickness of the disk. If the additional force near the edge is underestimated, the resulting value of the viscosity will be in excess.

7. Each of the forty experiments on dry air was calculated from the concluded values of the viscosity of the air and of the wire, and the result compared with the observed result. In this way the error of mean square of each observation was determined, and from this the "probable error" of μ was found to be ·036 per cent. of its value. These experiments, it must be remembered, were made with five different arrangements of the disks, at pressures ranging from 0·5 inch to 30 inches, and at temperatures from 51° to 74° F.; so that their agreement does not arise from a mere repetition of the same conditions, but from an agreement between the properties of air and the theory made use of in the calculations.

February 15, 1866.

Lieut.-General SABINE, President, in the Chair.

The following communication was read:—

"Further Observations on the Spectra of some of the Nebulæ, with a Mode of determining the Brightness of these Bodies." By WILLIAM HUGGINS, F.R.S. Received January 30, 1866.

(Abstract.)

In the first part of this paper the author continues his observations on the spectra of nebulæ and clusters. The results already presented by him to the Royal Society are confirmed by his new observations, namely, that with his apparatus clusters and nebulæ give either a continuous spectrum or a spectrum consisting of one, two, or three bright lines. The positions in the spectrum of these lines are the same as those of the bright lines of the nebulæ described in his former papers.

On account of the faintness of these objects the author was not able to ascertain whether the continuous spectra which some of the nebulæ give are interrupted by dark lines in a manner similar to the spectra of the sun and fixed stars. Some of these spectra appear irregularly bright in some parts of the spectrum.

The nebulæ which follow have a spectrum of one, two, or three bright lines; in addition to which, in the case of some of them, a faint con-

tinuous spectrum was visible. These bodies are probably gaseous in constitution.

No. 2102	27 H. IV.	No. 4499	38 H. IV.
4234	5 Σ.	4827	705 H. I.
4403	17 M.	4627	192 H. I.
4572	16 H. IV.		

The following nebulæ and clusters give a continuous spectrum:—

No. 105	18 H. V.	No. 4315	14 M.
307	151 H. I.	4357	190 H. II.
575	156 H. I.	4437	11 M.
1949	81 M.	4441	47 H. I.
1950	82 M.	4473	Auw. N. 44.
3572	51 M.	4485	56 M.
2841	43 H. V.	4586	2081 *h*.
3474	63 M.	4625	51 H. I.
3636	3 M.	4627	192 H. I.
4058	215 H. I.	4600	15 H. V.
4159	1945 *h*.	4760	207 H. II.
4230	13 M.	4815	53 H. I.
4238	12 M.	4821	233 H. II.
4244	50 H. IV.	4879	251 H. II.
4256	10 M.	4883	212 H. II.

The second part of the paper contains an account of a mode of determining approximatively the intrinsic brightness of some of the nebulæ.

Analysis by the prisms shows that some of the nebulæ consist of luminous gas existing in masses, which are probably continuous; and the nebulæ in the telescope present not points, but surfaces, in some cases, subtending a considerable angle. As long as an object remains of sensible size in the telescope it retains its original brightness, except as this may be diminished by a possible power of extinction belonging to celestial space, and by the absorptive power of the earth's atmosphere.

By means of a special apparatus the light of three nebulæ was compared with the light emitted by a sperm candle, burning at the rate of 158 grs. per hour. The results are that—

The intensity of nebula, No. 4628 1 H. IV. $=\frac{1}{1508}$th part of that of the candle.
" " annular nebula in Lyra $=\frac{1}{6032}$nd " "
" " Dumb-bell nebula $=\frac{1}{19604}$th " "

The estimation in each case refers to the brightest part of the nebula. The amounts are too small by the unknown corrections for the loss which the light has sustained in its passage through space and through the earth's atmosphere. These values have an importance in connexion with the gaseous nature of the source of the light, which the spectroscope in-

dicates. Similar estimations made at considerable intervals of time might show whether the brightness of these bodies is undergoing increase, diminution, or a periodic variation.

The paper concludes with some observations on the measures of the diameters of some of the planetary nebulæ. A very careful set of measures of 4232, 5 Σ, by the Rev. W. R. Dawes, F.R.S., is given, which makes the equatorial diameter$=15''\cdot 9$. Also measures by the author of 1414, 73 H. IV. which give its diameter in R. A.$=30''\cdot 8$.

February 22, 1866.

J. P. GASSIOT, Esq., Vice-President, in the Chair.

The following communications were read :—

I. "Account of Experiments on the Flexural and Torsional Rigidity of a Glass Rod, leading to the Determination of the Rigidity of Glass." By JOSEPH D. EVERETT, D.C.L., Assistant to the Professor of Mathematics in the University of Glasgow. Communicated by Professor WILLIAM THOMSON, F.R.S. Received February 1, 1866.

(Abstract.)

In these experiments a cylindrical rod of glass is subjected to a bending couple of known moment, applied near its ends. The amount of bending produced in the central portion of the rod is measured by means of two mirrors, rigidly attached to the rod at distances of several diameters from each end, which form by reflexion upon a screen two images of a fine wire placed in front of a lamp-flame. The separation or approach of these two images, which takes place on applying the bending couple, serves to determine the amount of flexure.

In like manner, when a twisting couple is applied, the separation or approach of the images serves to determine the amount of torsion.

The flexural and torsional rigidities, f and t, which are thus found by experiment, lead to the determination of Young's Modulus of Elasticity, M (or the resistance to longitudinal extension), and the absolute rigidity, n (or resistance to shearing); M being equal to f divided by the moment of inertia of a circular section of the rod about a diameter, and n being equal to t divided by the moment of inertia of a circular section about the centre. The "resistance to compression," k, is then determined by the formula

$$\frac{1}{3k}=\frac{3}{M}-\frac{1}{n},$$

and the "ratio of the lateral contraction to longitudinal extension," σ, by the formula

$$\sigma=\frac{M}{2n}-1.$$